

This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

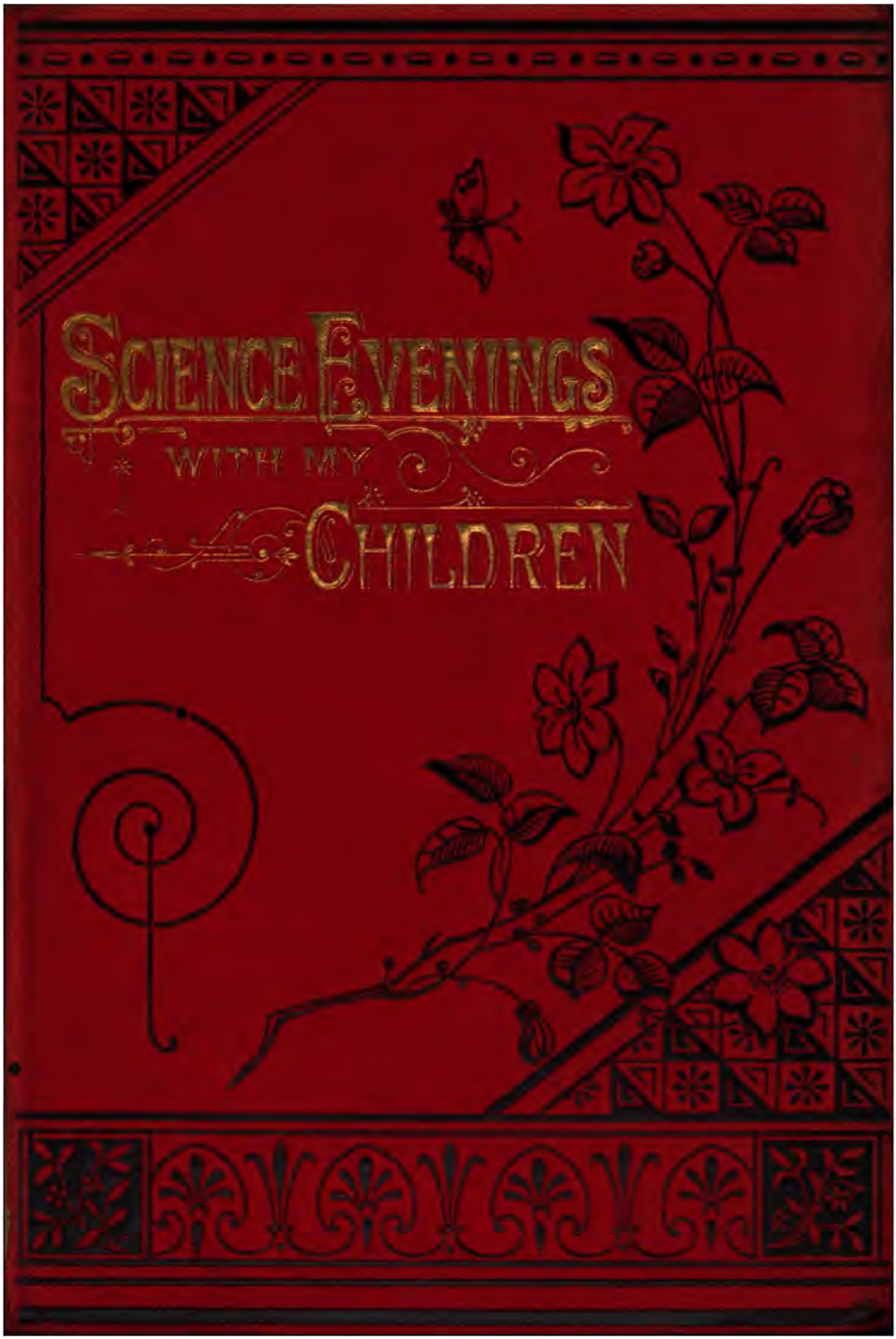
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`


SCIENCE EVENINGS
WITH MY
CHILDREN

600044761S





[*Frontispiece*, p. 9.

SCIENCE EVENINGS

WITH THE YOUNG.

BY

SELINA A. BOWER,

AUTHOR OF

"FROM ADVENT TO ADVENT;" "THE CHILDHOOD OF DISTINGUISHED WOMEN;"

"LET THERE BE LIGHT; OR, THE STORY OF THE REFORMATION,"

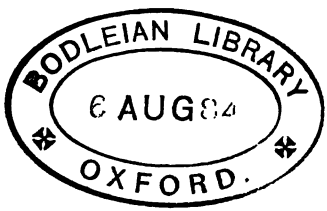
ETC. ETC.



LONDON:

JAMES NISBET & CO., 21 BERNERS STREET.

1883.



EDINBURGH:
PRINTED BY LORIMER AND GILLIES,
31 ST. ANDREW SQUARE.

PREFACE.

IN preparing the following papers for *The Churchman's Penny Magazine*, where they previously appeared, I consulted and studied the following books, and I am much indebted to their pages for both facts and theories,—Goodwin's "Course of Mathematics," Herschel's "Astronomy," Hind's "Solar System," Wood's "Natural History," two systems of Elementary Botany, one by Bland, and the other by Oliver; Mrs. Somerville's "Connexion of the Physical Sciences," and Joyce's "Scientific Dialogues."

Even in the present simple sketches I have found it not only difficult but impossible to reconcile discrepancies and differences between various authors, and the more modern extension of knowledge increases this difficulty. To obviate it, I have avoided positive figures as far as I could, or qualified them.

I have endeavoured to adapt the subjects to the

comprehension of the young, and to lead the thoughts beyond science, to that one Being who alone can give man wisdom, and also that higher wisdom, which makes "wise unto salvation." If the papers prove profitable in both these respects, in some degree, I shall be thankful that the effort has not been in vain.

SELINA A. BOWER.



CONTENTS.

CHAPTER		PAGE
I.	ASTRONOMY,	9
II.	ASTRONOMY,	16
III.	OPTICS,	22
IV.	OPTICS,	29
V.	NATURAL HISTORY,	35
VI.	NATURAL HISTORY,	41
VII.	BOTANY,	48
VIII.	BOTANY,	54
IX.	ELECTRICITY,	61
X.	ELECTRICITY,	68
XI.	MECHANICS,	75
XII.	MECHANICS,	80

SCIENCE EVENINGS WITH THE YOUNG.

CHAPTER I.

ASTRONOMY.

"SUSIE, dear, bring my low chair near to the fire, and we will discuss a little plan for our pleasant occasional half-hours. I want to give you an idea of some of the most simple sciences. We will have several different subjects, taking one or two evenings for each."

"What will the subjects be?" asked Hettie.

"Suppose we have astronomy—the sun, moon, and stars; then optics—you will like to know something about telescopes, microscopes, multiplying glasses, magic lanterns, and the rain-bow. Then we will have natural history. What is that, Lottie?"

"About hares and rabbits, and all those things," replied the child, smiling.

"Yes; I thought that you would brighten up if I spoke of animals and birds; and Nellie will be sure to like to know a little about moths and frogs, and the long, cold, slow garden worms. Perhaps, afterwards we can take botany—trees, and plants, and flowers; then electricity—falling stars, the Aurora Borealis, water-spouts, whirlwinds, and earthquakes all come under this as well as thunderstorms. Our last subject will especially interest George, I think, for it shall be mechanics—the wheel and axle, the pulley, the wedge, and the screw, are all called mechanical powers. Now, shall you care to hear about astronomy to begin with?"

"I don't *care* about stars," quickly, and almost impatiently broke from George.

"Gently," replied the mother. "Perhaps you will care when you know more about them. Those bright specks of light—need I tell you who made them?"

"God," said little Lottie, very softly.

"Yes, 'our Father made them all,' and they 'declare the glory of God' by showing us His power, His marvellous wisdom, and His never-ceasing watchfulness and care.

"The word astronomy comes from two Greek words, *Nomos*, a law or rule, and *Astron*, a star. So astronomy is a knowledge of the laws which

govern the stars. A law implies a lawgiver, does it not?"

"Of course it does," said Susie, with decision.

"The great God who made the stars established the laws which regulate them, and you will, I hope, learn something of His Almighty power by trying to think about the number, and sizes, and distances of these whirling worlds. What shall I tell you about first?"

"The sun," replied George and Nellie, together.

"That will do nicely, for as it appears to us the largest and brightest body visible, and is, besides, the centre of our own planetary system, we may as well begin with our own sun. The sun is a large luminous globe, rather more than a million times greater than our own earth."

"Greater! greater!" said George in amazed tones. "And is it all fire—fire?"

"Yes, dear; it is greater, and is a revolving body of light and heat. Though it is called one of the fixed stars, it is thought by many learned men that the sun has a course of its own through space, but this is not quite proved."

"Is it nothing but fire?" persisted George.

"It is a fiery substance, dear; an intensely heated, burning body, I believe."

"Then why does it not burn up!" continued the boy.

"Some things do not consume rapidly, George; and as we do not know the substance of the sun, we may suppose that God has made it of an inflammable material, which remains uninjured by its own light and heat so long as God permits it to do so."

"Now, what is 'revolving,' please?" asked George.

"By a revolving body I mean a body that spins round upon a supposed line through the centre, which is called its axis. Hettie, get me your large humming-top."

The top was produced.

"When I place it upon the peg and wind the string round, what does it do, as I draw the string swiftly out!

"It turns round," said little Lottie.

"Yes; it spins on the peg, which becomes the axis of your top. The sun revolves from west to east, performing one revolution on his axis in about twenty-five days. But do you not wonder *how* we know that the sun thus revolves?"

"How?" asked George, eagerly.

"Astronomers have watched the sun through their telescopes, and they tell us that there are spots visible upon his surface. Now, these spots re-appear as regularly as our own night and

day; the days have been counted between, so that it is certain that his revolution takes twenty-five days.

"George, you know how far the sun is off, do you not?"

"Oh, yes, I *do* know *that.* It is over ninety millions of miles away. I suppose no one lives there—or, at least, if they do, they must be made of iron, or something which does not burn."

"Distance prevents us from discovering whether the heavenly bodies are inhabited. The sun is the centre of a planetary system; the planets are globes similar to our earth, though they look like large stars. The nearest to the sun is called Mercury, then come Venus, the Earth, and Mars. Then fifteen smaller planets which seem almost like fragments of one large one. Next we have Jupiter, Saturn, Uranus, and lastly Neptune. All revolve round the sun at different distances in paths called orbits. They are kept in their positions by the power of attraction. I will try to explain this. If you have a ball in your hand and let it go, what does it do?"

"It drops on the floor," said Susie.

"It falls; the sun has the same power over the planets which the earth has over your ball, it draws them towards itself. The planets have a tendency to fly off, so between the drawing

influence of the sun, and their own impetus from the sun, they are retained in their orbits at certain distances. Our earth revolves from west to east on its axis once in twenty-four hours, and this gives us day and night, for the part turned towards the sun receives his light and heat, and as the earth goes round she has morning, noon, and night at each particular spot on her surface. What do we call the beginning of day?"

"Morning—sunrise," said Susie.

"And the end of day, sunset—but the earth itself moves round and round, and thus obtains day and night. We say sunrise and sunset because it *seems* as if the sun moves, rather than our globe. Sunrise and sunset are at different hours in summer and winter, because the earth not only turns round herself, she also revolves round the sun in 365 days, and as her axis is slightly sloping, the rays of the sun fall obliquely, or slanting, upon her surface at times, and thus lose some of their power and so produce winter. Therefore in her journey round the sun the earth obtains more or less heat and cold in proportion to the direction in which she receives the rays of the sun. We could not live without light and heat from the sun, nor could any vegetation exist, for sunshine produces all those natural, electrical, and chemical changes upon

the atmosphere and surface of the globe, which, either directly or indirectly, sustain animal and vegetable life. Now can you tell me any verse about the sun?"

Susie suggested the story of the sun and moon standing still in the valley of Ajalon whilst God gave Israel a victory.

Then Nellie quietly repeated "Praise ye Him, sun and moon; praise Him, all ye stars of light!"

"They do praise God, Nellie, and show 'His handy work' to us, do they not? We may very safely trust in a God that by wisdom made the heavens! We may trust Him for everything all through the year which is beginning."



CHAPTER II.

ASTRONOMY.

"HAVE you the letters here, children?" asked the mother one evening.

Susie went for the box containing several sets of the alphabet, and at the mother's suggestion the letters were selected which spell Astronomers and Astronomy, to be transposed.

Susie, who had taken Astronomers, soon found the words, "No more stars—sea nor storm—rest, O Romans!"

George and Hetty had "Stray moon—to yon Mars" from their word Astronomy.

"That will do, dears," said the mother, who saw that the interest of the children was now fully gained. There are several more sentences, I know. Suppose we have "more on stars," and you may all be little "moon starers," for we will have some facts about the moon, if you care to listen."

The letters were soon put away, as the mother continued: "I suppose that the moon seems to you nearest in size to the sun. In reality it is not so."

"It is even smaller than the earth," interrupted George.

"You are right. The earth is nearly fifty times as large as the moon. The moon travels round our earth continually, taking about twenty-nine days and a-half to get once round. This is one of nature's divisions of time. What do we call it—it is nearly thirty days?"

"A month, I suppose," George instantly replied.

"Yes. Now for its distance from us; it is only 238,650 miles away. It is not a luminous, fiery body like the sun, but a reflector, and it shines by a light borrowed from the sun. Sometimes there is a little curved strip of moon, sometimes a half moon, and sometimes three-quarters, or a whole moon. This is because we only see the portion of it that is turned to us, of that half of it which catches the sunlight. The day and night of the moon are just the same length as her journey round the earth, for she revolves on her axis in about thirty days. This is why we always have the same side of the moon opposite



to us. The dark figures on the surface are hills: they have even been measured, when seen through a powerful telescope, and some of them are about three miles high. Many of these mountains are volcanoes; names have been given to them, and also to the thirteen largest supposed seas—though it is doubtful if the hollows are really seas, but they are certainly depths, and some of them look greenish, as if they contained water. Both the sun and moon, and particularly the latter, affect the waters of our earth. What do we call them?"

"Rivers—seas," said Nellie in a breath.

"And our seas have—what, Nellie?"

"Tides?" was the reply interrogatively. "Yes; these are caused by the attraction of the substance of the moon when it is exactly over any spot, or, as it is called, vertical. The moon, being comparatively near, attracts with the more power. Sir Isaac Newton tells us that the moon raises the waters ten feet, and the sun only two. As the earth turns upon her axis, and the moon also revolves round the earth, we have two tides, because the waters rise equally on each side, thus—they rise exactly where the moon is vertical, and also exactly opposite on the other side of the globe. This can be explained by the laws of attraction. When both sun and moon are vertical together, we have the high tides called spring

tides. This happens twice in the month, at new and full moon. The lowest tides are called neap tides.

"I must now tell you something about the stars which shine and tremble so beautifully in the dark concave space that appears above us when the nights are clear. These are called fixed stars; they do not seem to change their relative positions. Their degrees of brightness may arise from variance in distance, rather than size; still from the extent of this brightness they derive what is called magnitudes. Stars do not shine by light borrowed from our sun; probably they are themselves luminous bodies, and possibly they may be speeding along through space in different tracks. The apparent fixed position of the stars has enabled scientific men to find out the path which the sun takes annually, and to which they have given the name of the ecliptic. The Zodiac is a sort of expansion of the ecliptic—an addition to each side of the constellations, or groups of stars, through which the sun appears to progress. These constellations are twelve, and they are called the twelve signs of the Zodiac. This word is derived from the Greek, and means belonging to animals, and the names of animals have been given to the greater number of these groups of stars which compose the Zodiac."

"Tell us the names," said Nellie."

"Aries, the ram; Taurus, the bull; Gemini, the twins; Cancer, the crab; Leo, the lion; Virgo, the virgin; Libra, the balance; Scorpio, the scorpion; Sagittarius, the archer; Capricornus, the goat; Aquarius, the water-bearer; and Pisces, the fishes."

Little Lottie's face had been gradually glowing with delight, as her friends' names were repeated, and she exclaimed—

"Those are the very *things* on Papa's 'Whitaker!'"

"Of course they are," joined in Hettie, who continued, "but, what *is* the Zodiac and ecliptic? I do not understand."

"Shall I try illustration? The sun, with all his planets, is ever journeying round the heavens in a yearly circle amongst the constellations."

"What are constellations?" inquired Nellie.

"Groups of stars to which are given names to distinguish them, such as the Great Bear and Orion. If you were going on a journey, how would you travel?"

"By railroad," replied the children.

"Very well; we will call the railroad your ecliptic. What would you pass?"

"Towns and villages."

"Exactly. They will do very well for constellations, the houses representing stars, and

thus forming your Zodiac through which the exact line of your railway, or ecliptic, runs. The sun's ecliptic is his grand railway through space, and the constellations of the Zodiac are the towns and villages along his path. Now one word about the Milky Way. This is a broad band of what appears to us like light cloud stretching across the sky, but really it is composed of numberless stars, so thickly clustered as to look thus to us owing to immense distance."

"Stars can be seen in daylight from deep places and pits—can they not?" asked Susie.

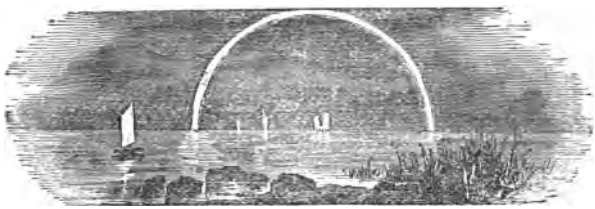
"Yes; they are always round us day and night, and though not visible usually in our sunlight, they are, nevertheless, in the sky."

"Can you count the stars, mother?" inquired little Lottie.

"No darling, indeed I cannot; but we see about a thousand generally, I believe, without telescopes."

"I am sure I *cannot* think how God made them," continued the child. "Can you?"

"No, Lottie; this shows us how great and wise and powerful God is. Perhaps we shall know much more about His works in His own heaven, if we seek for His Holy Spirit to make us like Jesus, Who calls Himself 'the bright and morning star,' and, if made like Him, we shall also live with Jesus in His Father's holy presence."



CHAPTER III.

OPTICS.

"WHAT do you think this word means, Lottie?"

"*I* can't tell," replied the little girl.

"It has to do with our seeing," said Susie.

"Yes; the science of sight is called optics. Now what do we see with?"

"Our eyes," said Lottie, quite clear upon that point.

"Can our eyes see always?"

"Not when we are asleep, and in the dark," said Hettie.

"Then eyes alone will not do?"

"Is it light you mean?" inquired Nellie.

"I do; for light enables us to see. Scientific men do not agree as to what light is. They tell us that it is either corpuscular, which means it comes to us in tiny, *tiny* atoms; or it is undulatory, that is, pouring on in small waves. How-

ever, all agree upon one point—we receive light from——"

The mother paused.

"The sun," chimed in all the children.

"Yes; and, as it is only eight minutes on its long journey, light travels nearly twelve millions of miles in one minute."

"More than ninety millions of miles," said Nellie, musingly, "*that* is the sun's distance, so it does come quickly.

"Light travels in straight lines. If you look at anything through a bent tube you cannot see it because the rays from it are straight, and cannot bend round the tube. The sun's rays do not reach us in quite direct lines, for our atmosphere being more dense than the medium beyond, or space, it possesses the power of refraction, just as water has the same power with reference to the atmosphere itself. To refract is to bend. Do you understand?"

"I think so," said Nellie. "I know if you mean this—when we put a stick in the water it looks bent, and even a spoon looks so in a glass—just a little."

"The bent or oblique part is the refracted part. Our atmosphere is dense enough to be measured as far as fifty miles all round our globe, beyond this it probably extends quite thirty miles, and,

being nearly transparent, light passes easily through it. Still no substance is perfectly transparent; the atmosphere, glass, the diamond, and crystal, form no exception to this. And no substance is perfectly opaque; even the hardest, and closest, and darkest things are slightly penetrated by light. According to the density or opacity of a substance the rays of light are bent in greater or less degree. A ray of light is one or more of the atoms of light thrown off by the sun; a pencil of rays, is a number of rays proceeding from one point, called the focus; parallel rays are those which run side by side. Light is reflected as well as refracted; that is, it is thrown back at an angle from every object which we see, and strikes upon our sight so as to produce the impression of that object in our minds. It can also be variously collected, reflected, and refracted by lenses. Tell me if you quite understand these words?"

"I do," replied George; "collected means brought together."

"Reflected is thrown back," quickly put in Nellie.

"Refracted is bent," quietly added Susie.

"I will tell you more about this when we come to telescopes. The lenses are properly nine in number, but I need not give you the names of

them. They are all more or less convex, that is bowed out, or concave, that is bowed in, and owing to this they more or less refract the light."

"What are they made of?" inquired one of the children.

"Glass lenses are principally in use, for they must be nearly transparent. I will tell you presently of a natural lens, which is fixed in the eye, and receives the rays of light, and by which we see."

"Then we see because our eyes are full of light," exclaimed Lottie, in great triumph.

"Let me try to explain, Lottie; but first tell me who made the eye?"

"God did," was the reply.

"Then you will understand a little how wise and infinitely clever, if I may use the word, God must be. What shape is the eye?"

"Round, or nearly round," said George. "What is it filled with?"

"Your reply is correct as to shape. Then it has three coats, or coverings. The outer one is called the *sclerotica*, it is opaque, and forms the white of the eye, though just in front it is transparent and also slightly bowed out; this portion is called the *cornea*. The second covering is a thin membrane just inside the first, called the

choroides. This extends on either side as far as the sclerotica is opaque, and where it joins it near the transparent part it is met by the *uvea*, or *iris*, or coloured portion. This coloured portion is a contracting membrane, and surrounds the pupil, which it dilates and expands. The pupil is the dark, small circle in the centre. Again, within the choroides we have the *pigmentum nigrum*, a black covering which absorbs any rays of light which might confuse our sight; and quite at the back of this the *retina*, or network, is placed, which receives the images of objects. The *crystalline lens* lies behind the space which we call the pupil, and is a soft, clear substance, in the shape of a double convex lens. The *aqueous humour* fills the space between this and the cornea, and the *vitreous humour* is in the whole of the interior behind, it is almost like melted glass, and the aqueous humour is watery. The optic nerve is at the back of the eye, near to the nose. Now you see with what the eye is filled. What do you think the eyebrow is for?"

"To keep bits out of the eye," said George.

"Yes; and to shade it from too much light. [illegible]ve-lash also protects the eye from dust. [illegible]e lid?"

[illegible] shut the eye up when we go to sleep."

And Hettie's eyes twinkled with fun as she closed them tightly for a moment.

"It also keeps the eye moist by a fluid which it diffuses over it constantly. Now you know the parts of the eye, you can follow me as I tell you *how* we see. Rays of light from objects fall upon the cornea, and pass through the pupil and through the aqueous humour into the crystalline lens, which refracts these rays and sends them on through the vitreous humour to the retina, where they make an exact picture of the object, which the optic nerve conveys to the brain. Only one impression is made upon the brain, though both eyes see the object, because the axis of each eye is directed to the same point. Whose eye sees always?"

"God's," said little Lottie.

"Yes: and His eye, which really means His knowledge of all that occurs, is never dimmed by the darkness. What verse can you remember about God seeing?"

Susie asked, "Do you mean what Hagar said?"

"Quite right. 'Thou God seest me.' This should help us to try to please Him, for He watches for our love. How can we please Him?"

"By doing as He wishes," said Nellie.

"By grace," put in Lottie.

"It is only by the grace of His Holy Spirit, darlings, that we can do God's will; and He is most pleased when we give our hearts—that is, our whole love, to His Son, Jesus Christ, our Saviour."

CHAPTER IV.

OPTICS.

"CAN any of you tell me the use of the telescope?"

"It makes things that are distant appear near. The ships at sea seemed quite close when the coastguardman let us look through his glass," replied George.

"Why are distant things indistinct?"

"They are too far off for us to see them," said Nellie.

"That means—first, they are so far off that few rays of light reflected from them reach our eye; and secondly, the *visual angle* is too small."

"What is the visual angle?" inquired Susie.

"The angle formed by the rays from an object as they meet at the eye. Distant objects must be magnified to increase the angles. This is effected by a double convex lens, or by a concave mirror, either of which also collects more rays of light from the objects, and carries them to the

eye, so rendering the distant things plain. There are refracting and reflecting telescopes. The former consists of a tube containing the object-glass—a double convex lens—and the eye-glass —which may be a double convex, a double concave, or a plano-concave lens. The tube limits the view, and confines the rays of light, and its smaller sliding tubes enable us to adjust the two lenses so as to suit our individual sight."

"I quite understand all that," volunteered George. "Now tell us about the large telescope."

"You mean Dr. Herschel's. This is a reflector, and consists of a concave mirror which receives the rays of light from the object, and transmits these rays through a lens to the eye. The mirror has stronger magnifying power than the double convex lens. The tube of Dr. Herschel's telescope is forty feet long, and its diameter is four feet ten inches; it magnifies 6000 times. Four years were spent in its construction. There is a disadvantage in the mirrors. As they are made of highly-polished metal they become dimmed by damp, and do not retain their brilliancy more than two years. Now tell me what the microscope is for."

"To make the wings of beetles, and tiny flowers, and mites of leaves plain," replied George.

"To enlarge the appearance of small objects

so as to give them distinctness and definite size. How is this done?"

"By putting them quite close to the glass; and yet I don't see why that makes them large," said Nellie.

"The microscope you have, Nellie, is a single one, and consists of one double convex lens, that is a bowed out lens.

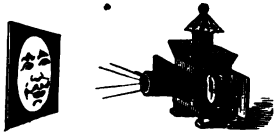
"Then by putting an object close you increase the visual angle; the lens, too, collects more rays of light, as well as expands the rays that are transmitted or passed through it, therefore the object gains in brightness as well as in size, and numbers of points, and marks, and forms become visible, because the rays from them are thus collected and carried to the eye. A compound microscope has two lenses, and the eye-glass being larger than the object-glass, the magnifying power is increased. There is a third kind — the solar microscope. This requires a looking-glass placed at an angle outside a window so as to catch the sun's rays and throw them on a large double convex lens, which brings them to a focus, just beyond the object, upon another lens; the impression is received upon a sheet. The object must be transparent. Microscopes formed by various lenses differently placed abound, but I could not describe all these to you."

"What is a multiplying glass?" inquired Susie.

"A simple piece of thick, clear glass cut into a number of surfaces at slightly different angles on the one side, and left plain on the other. When you look through at a thimble, for instance, you see not one thimble merely, but as many thimbles as your glass may have surfaces. Each surface receives rays from the thimble, and, being distinct, transmits the impression of the thimble to your eye. The centre one is seen in its right place, the oblique surfaces catch the rays slanting, and pass them on slightly refracted. After leaving the glass the rays are reflected, so that they seem to place the thimble in different directions. The magic lantern comes next.

"We have seen several," said Susie, George, and Nellie.

"Inside the tin box a light is fixed which



passes through a large plano-convex lens fixed in the tube of the lantern. This light falls upon the strips of glass which are placed upside down in front of the lens; the pictures painted on the strips appear on the sheet which is hung to receive them. A mirror at the back of the lantern adds to its light and

power. A little about the rainbow must close our chat on optics. What are its colours?"

"Prismatic colours," answered Susie.

"Shall I tell you how these are formed? But first let me hear what colour light is."

"White," replied Nellie.



"Each ray of white light can be divided into seven different colours by a three-sided glass, called a prism. Tell me the colours."

"Red, blue, yellow," replied Lottie, stopping short.

"In this order, Lottie: red, orange, yellow, green, blue, indigo, violet. They are not all equally refrangible, that is, some colours are more bent than others. You can only see a rainbow when you stand between the sun and the shower, with your back to the sun. The lower the sun is in the heavens, the higher the bow will be, and *vice versa*. It is thus formed—a ray of light falls upon a drop of water, and makes its own tiny, wee prism in the drop itself, by being refracted as it enters the drop and passing through to the other outer edge, a part of it is reflected to a third point of the circle of the drop. This water-prism divides the ray into the seven colours."

"Then why does not the bow fall with the drop?" asked George.

"Because it can only be seen when the eye, the sun, and the drop are at a certain angle, and it is formed continuously upon the succession of drops which fall just at that angle. Tell me where we hear about the first rainbow?"

"After the flood."

"Yes. Why did God send that flood?"

"Because people were wicked and God destroyed them," answered Nellie.

"This strongly shows God's hatred of sin, and He *must* punish sin, because He is holy. How, then, can we escape from destruction for our sin?"

"By believing in Jesus," replied Nellie.

"Who puts this belief in our hearts?"

"The Holy Spirit," answered Hetty.

"Yes; and when we see the bright beauty of the bow above, we can think of it as God's glorious sign of His forgiving love, and His promise not to destroy man hopelessly again."

CHAPTER V.

NATURAL HISTORY.

NATURAL HISTORY is a very extensive study, generally carried on under two *Divisions:* I. Vertebrata, which consists of animals having a spine composed of jointed hollow bones, wherein lies the spinal cord which communicates with the brain, and is, in fact, almost a continuation of brain. From this cord smaller cords pass, generally in pairs, to the different limbs and parts of the body, and spread themselves in delicate silk-like threads throughout, and we call these threads——can you tell me?"

"Nerves; but do they come down to our very finger ends?" asked George.

"Yes, and they take every sensation to the brain. I can only compare them to the telegraph, which, you well know, silently conveys messages. The nervous system of each man seems to me a living telegraph transmitting news to the brain

through the eye, the ear, the nose, the mouth, and every member that he possesses.

"II. Invertebrata. Under this second Division we find animals which have not a spine and vital cord, but their nervous system is constructed in the form of *nuclei* or *ganglia*, a central knot from which the nerves spread around. It is almost like a tiny ravel of fine silk when the ends have been pulled out in a vain attempt to straighten and wind it up. Sometimes these ganglia abound in different parts of the bodies of those creatures to whom they seem given instead of brains; the ends spread through their system, and compose their nerves. Under the two Divisions we have nine Classes and numberless Orders. I hope that you will see the British Museum before long, and there you will have the opportunity of making the acquaintance of the various animals belonging to each. I will tell you the names of the first three Classes now, and leave the six last until another time. Class I. Mammalia. II. Aves. III. Reptilia. I think that you will remember them, if we take one, or perhaps two animals under each. Tell me the principal, most important, and intelligent animal."

"I suppose the dog," said George, "or a horse."

"Is it *man?*" inquired Susie, doubtfully.

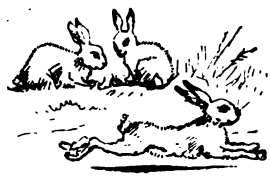
"Yes; man *is* an animal, though infinitely superior to others, because he has a 'living soul.' Are all men alike?"

"No," replied George, "some are negroes, some copper-colour, and some white."

"These are different races, but philosophy affords proof amply sufficient to show that the Bible account of Adam and Eve is true, and all these races sprang from one source; circumstances have produced the differences in races.

Man is superior to the lower animals in four prominent respects besides his spirit. First, in the form and size of his skull, which contains his brain; the ape, which is most like man, has a heavy skull and prominent jaw. Secondly, man is erect; no other animal can walk upright. You cannot call the clumsy gait of the ourang-outang a walk. Thirdly, man has ability to invent and construct things by which he lives, whether they be the bow and arrow of the savage, or the refinements that procure, produce, provide, and supply civilised life. And fourthly, man has the power of speech, and can communicate his thoughts by articulate language, that means, by spoken words. These prove man to be possessed of reasoning power and intelligence; whereas animals are guided by instinct which teaches them merely to use appliances, such as teeth,

claws, jaws, and so forth, to provide for daily wants. I think that I promised a short account of the hare and rabbit, which shall be our other animals. They are very, very much alike. The hare is larger and has a redder brown fur. Both are particularly fleet, and this is their provision for defence, as it enables them to escape from enemies who would destroy them. They are also quick to hear and see a foe, and very timid. The Alpine hare turns white in winter. Hares do not make burrows like rabbits, but they form grassy nests where they live and hide. What shall we have under the second Class—Aves?"



"Larks," suggested Susie, "for Lottie painted one the other day."

"The little skylark is very busy, Lottie, this month (May), with its first brood of little ones. The second brood comes about August. Skylarks are found not only in England, but throughout Europe, Asia, and in the North of Africa. The hind toe of this bird is very long. The nest is on the ground in some tiny hidden hollow, perhaps behind a



root of grass, or in the print of a horse shoe, and the eggs are lightish green, spotted with wee brown spots. The skylark's song is a beautiful trilling warble, which it sustains as it soars towards the sun. You often see them and hear them.

"Now shall we have the ostrich, which is the largest bird that exists? It is six or eight feet in height, and is a native of Africa. It is easily tamed. The legs are exceedingly strong, and it runs swiftly, but the wings, from which we have the beautiful feathers, are small and weak. The ostrich makes a large hole in the sand near to low bushes, if possible, for her eggs, and two hens will lay in the same nest, just as fowls do. Both the cock and hen birds help to hatch the eggs, and take great care of their young ones; formerly it was supposed that the eggs were left to be hatched by the heat of the sun, this was a mistake. We now come to the third class, Reptilia."

"Was that horrible creature in the Brighton Aquarium a reptile?" inquired Susie.

"Yes, dear; if you mean the alligator in the tropical room, and it will do for our subject nicely. It is a native of America, and abounds in the North American rivers especially. Its food consists of fish and any small animals that it can catch. The alligator lays its eggs in the river bank, but few of them comparatively are

hatched, as other creatures devour them. The



word reptile is from the Latin word *repo*, I creep, and is descriptive of the whole class of snakes. Their movements are owing to the formation of the vertebræ; each joint is like a ball and socket, so that the spine is perfectly flexible. The circulation, too, of reptiles is peculiar, and distinguishes them from every other class. Hettie, tell me the first history that we have of a serpent?"

"The serpent that tempted Eve," replied the child, quietly.

"What did he tempt Eve to do?"

"To eat fruit that was forbidden," Hettie continued.

"Yes. This was the first sin against God. But who was this serpent, really?"

"Satan," said Hettie.

"And does Satan, or the devil, still tempt us?"

"Yes," responded all the children.

"He does, and we can only resist his temptations by seeking the power of God's Holy Spirit. Can we be forgiven the sin thus brought upon all our race by disobedience, and those sins, too, into which we are tempted?"

"Yes; by believing in Jesus," replied Nellie.

CHAPTER VI.

NATURAL HISTORY.

"UNDER Class IV. we can take up Nellie's little friends, the frogs, for this class is *Amphibia*. Both frogs and toads are called tadpoles when very young, and are those funny, tiny things in the shallow water of the river below, with heads and tails and apparently no more. They cannot live out of water then. In one or two days these tadpoles have four little legs; then the tail soon disappears, and the animals undergo other changes which render them amphibious, that is capable of living either on land, or in water, but if in the latter they have to come up to breathe continually. Both frogs and toads sleep during the whole winter. Their food consists of insects. Toads periodically change their skins, and—what do you think they do with the old coats, Lottie?"

"Gulp them up," replied the child, decidedly.

"Not a very elegant phrase, Lottie, but the

toad does knead his skin into a ball, and then he swallows it. Now what fish shall we have? *Pisces*, or Fishes, is Class V."

There was a general demand for sharks, and mackerel, but Hettie pleaded—"It must be cod, because of cod-liver oil."

"We will have one at a time, for these fairly represent the class. Susie asks for sharks. It



is one of the largest fishes, sometimes attaining to thirty-seven feet in length. It is exceedingly voracious, and swallows various things as well as animal food, which it takes either dead or alive. There are several kinds of sharks, for some small fishes belong to this family, as the dog-fish for instance. The two largest kind are called the hammer-headed shark, which has a head like a double hammer, and is from seven to ten feet long; and the white shark which is the one so much dreaded by sailors. This last is found in the Mediterranean, and in many tropical seas; its colour is ashy-brown above, and white below. The shark turns on its side to catch its prey, because its mouth is set so much under the upper jaw. The mackerel is a very pretty fish, beautifully marked with dark blue and black upon brilliant green. It is prized for food as well as

beauty, and is often plentiful on our own shores. Shoals of these fish appear about June, and they are easily caught by lines from boats. Like the



shark the mackerel is very greedy. One or two words about the cod, Hettie, from which the oil is made. This fish is about three feet long, and often twelve pounds in weight, and the colour is rather a greenish-grey, just a little mottled, though it is white, as so many fishes are, underneath. It is common to most shores, very plentiful, and caught by hook and line. The liver yields immense quantities of oil, and the best is obtained by throwing the fresh livers into a pan immersed in another pan of boiling water. The oil then drips slowly out, and only requires straining. We now come to Division II. *Invertebratæ*—animals without spines. Class VI., *Mollusca*, will be the first under this; we will take the cuttle-fish for our example. It forms one of the exceptions to its class in the possession of both eyes and ears, for few have either. It is, however without any shell. With eight long tentacles it crawls along, and catches and holds its food, consisting of small fish of various kinds, and the mouth is so strong that it can break the shells of these tiny fish, and so obtain the

inmates. The body is soft and almost like a bag. Now what colour do you think we have from it?"

Various colours were quickly guessed.

"Sepia is made from the dark substance which this fish secretes, and by which it blackens the water to enable it to escape unseen from its enemies. Cuttle-fish bone is obtained from the mouth, being a formation of many tiny layers, and it is capable of pulverisation."

"Whatever is *that?*" asked Nellie.

"Powdering, dear. The common earth-worm comes under the many orders of vertebrata, and belongs to the *Annelida.* It is composed of rings and muscles which render it so flexible and elastic. It has tiny bristles in sets of eight to each ring, and crawls by these instead of feet. The worm feeds upon leaves and roots, it is particularly fond of primrose leaves; it breathes by spiracles. The next, Class VII., is called *Crustacea.* These animals have no bones, and are protected, supported, and sheltered by shell in various forms. Some of these creatures have even their claws encased. As the shell does not expand with the growth, it is cast off annually, and replaced speedily by a fresh one; or if one of them loses a limb, it can also replace that and soon does so. Lottie asked about the shrimp, so will take it as an example. Shrimps live in

the sand principally, and, like prawns, they have the ring kind of shell, these rings fitting into each other and working about so as to allow of movement and progression. They are caught as you know by nets. Class VIII., or *Arachnida*, comprises spiders of all descriptions, and, I believe, the scorpion. Spiders are not insects, for they are not divided or *in sections* as that word implies. They have also eight legs, whilst insects have six, and they do not pass through the stages that affect all insect life. You are familiar with many spiders, so I will tell you a little about the web. It is a kind of dusky-looking silk, and is formed like silk from a gum that is prepared in, and pressed from, the spider's body by a curious apparatus. Enough of this silk has been procured to weave into gloves, but as spiders are very quarrelsome the silk cannot be obtained in large quantities. Under Class IX., *Insecta*, we must have Nellie's aversion, the moth. But I must tell you that insects pass through three states. First, *larva*, or caterpillar; secondly, *pupa*, or chrysalis; thirdly *imago*, or the perfect insect. They have six legs, and eyes that are almost composed like a multiplying glass, each facet, however, representing a perfect eye. The



common house-fly possesses 8000 of these lenses, and some insects have more. Each insect is in three divisions or sections—the head, the thorax, or chest, and the body, so to speak. They breathe through tiny tubes, which communicate with every part, and are called *tracheæ*. These tubes are composed of spiral rings and membranes, the rings keep the tubes open, and in some degree these tubes resemble the windpipe, as the name tracheæ implies; their openings are called spiracles. The small brown moth, that Nellie does not like, is the common clothes moth, and in forming its sheath for its chrysalis state, the caterpillar eats the woollen cloth upon which its eggs were laid, so that the case is itself the colour of the flannel where it lives. This makes this tiny insect destructive to wool or fur. What does our Lord say about this?"

"'Lay not up for yourselves treasures upon earth, where moth and rust doth corrupt,'" quoted George.

"'But lay up for yourselves treasures in heaven, where neither moth nor rust doth corrupt,'" added Susie.

"Our natural history very powerfully teaches us not only that earthly 'treasures' pass quickly away, but that earthly life too is equally

uncertain. The 'treasures' in heaven last for ever, and the life there, is an endless day. Let us all try to remember those words by which we may know if we are following the command of Jesus as to our 'treasures.' 'Where your treasure is, there will your heart be also.'"



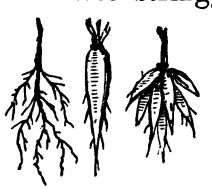
CHAPTER VII.

BOTANY.

"WILL you tell us about all kinds of flowers, mother?" said Susie, pleadingly, when the subject of Botany was incidentally mentioned.

"First, I will tell you the names of the parts of plants, and slightly describe them; for botany includes their structure and process of growth, as well as their chemical changes, classification, and geographical positions. The roots, stems, leaves, flowers, fruits, and seeds, are the most simple divisions. We will glance first at roots. These are sometimes *fibrous*, like cotton-ends."

"Those stringy roots?" said Lottie, who had a small experience of weeding.



"Yes, dear. Then *tap-roots* are long and pointed like carrots. Or these pointed roots may be in connected bunches; if so, they are called *fasciculated*. And there is a

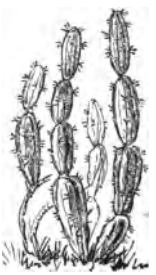
fourth kind, less common, which is ringed, or *annulated.* The roots hold the plants firmly in the ground, and also suck up nourishment, so that they are in a double sense supporters. Secondly, we have stems, which sustain the leaves, flowers, and fruits. The little notches from which the leaves start are called *nodes.* The tissues of stems vary. In some the growth is in layers from the centre; they are then called *exogens,* because they grow outwards. Others increase in size by new fibres forming irregularly amidst the old; these are called *endogens.* Leaves come in the third place. Each leaf consists of a *lamina,* or flat portion, and its stalk, or *petiole,* which usually runs up the leaf to its point or *apex,* and thus forms the *midrib* of the leaf. Veins of leaves are either parallel, or branched into network. Besides veins, leaves possess tiny mouths, which are dotted over them on both sides, though more so on the under side; by these *stomates,* or mouths, they receive carbonic acid gas from the air. Simple leaves are those that grow single; compound leaves grow in groups upon one stem. The edges are *entire* when they are smooth, *serrate* when they resemble a saw; *crenate* when they are in scollops, *dentate* when toothed, *ciliated* when surrounded by hairs, and *sinuate* when waved or bent like Lottie's oak-leaf. Flowers, which we

take fourthly, each possess the *bract*, or external sheath—the *calyx*, or cup, the green surrounding the petals—the *corolla*, or coloured leaves—the *stamens*, which hold the dust-like stuff called pollen—the *pistil* which collects this pollen and conducts it to the *ovary*, or seed-vessel—and the *ovary* itself which eventually forms the fruit. This brings us to our fifth division; fruits, which contain the seeds, as you know, in a variety of ways—the apple in the core, the pea in the pod, the gooseberry in the pulp, and the nut in the shell; but it would take too long to give you the names, or describe the formations now. Our sixth part is the seed. Each consists of the *carpel* or leaf, that encloses the whole; and the *stigma* or style, to which is attached the *testa*, or inner skin, containing some *albumen*, and the *embryo*, or germ of the future plant. The *pericarp* is a bag which encloses numbers of these seeds. Now do you think that you have an idea of the principal parts of plants?"

"Yes," answered Nellie, very decidedly.

"Scientific men tell us that each part of every plant is only a different formation and adaptation of its leaf. Thus the seed is composed of two leaves, as we see in the case of a common bean; when the two lobs appear above the ground, they are really only two thick sappy

leaves. Stems too are leaves curved into columns, this we easily trace in many grasses. Some plants, the cactus, for example, are composed of jointed leaves alone. Buds of plants are merely folded leaves, protected by scales, these scales themselves being hardened leaves. Flowers are groups of leaves, arranged and coloured not only to protect the developing seed, but also thus wonderfully coloured in order to attract and transmit the sun's rays in proper proportions for the ripening of the seeds. Their little crowns (*corolla* means a little crown) of dainty leaves allure, by their gay glory, the pretty insects amongst the fair beauty of their petals, where they perform one unconscious but needful purpose of their lives, the scattering of the pollen which render the seeds fruitful. Stamens and pistils too can be so cultivated as to become leaves, for it is thus that double flowers are produced. The full roses of our gardens are but modifications of the common eglantine roses with their stamens and pistils thus developed. The fruit too is but a leaf—the stones of plums or the cores of apples are really the epidermis, or upper skins of the leaves hardened to protect the seeds; the flesh



of both these fruits being the cellular tissues swollen and charged with juice or sap endowed with properties for nourishing the kernels or pips; whilst the peelings are the lower cuticles of the leaves folded round and tinged with sun-bloom. In the forms of perfect leaves, we can trace, as in the leaf of Lottie's oak-tree, the outline of the tree itself. What shape is each leaf on her pretty plant which is now growing rapidly?"

"Rather long and *ruckled*," instantly replied Nellie, whilst Lottie took her mother's pen and soon sketched the rough form on an old envelope, saying—

"There—I can't tell you, but you see I can draw it," for Lottie loved her pencil though only seven years old.

"A very fair leaf, Lottie; and now look, is it not almost the shape of that large oak-tree on the Taverham estate, beyond the river Wensum, which is so conspicuous from here? Again, if you examine the delicate marks and veins of leaves, you may find a picture of the trunks and boughs. I will explain this. Leaves that have veins spreading in pairs from the same point of the centre vein, belong to plants whose stems grow from exactly opposite sides of the main stalk. Leaves that have veins growing out irregularly, first a vein on one side, and then a

vein on the other side a wee bit further on, grow on trees whose boughs and branches spring alternately from the trunks. Or in the angular, all-about kind of way in which some leaves are veined, you may trace the picturesque, confused beauty of the trees from which they have been plucked. Narrow, spiked, pointed leaves, indicate tall trees; broad, bulky leaves, spreading ones. All this shows one grand design of God, and the simplicity of His creative plan in having a *leaf-type* for the whole of His work, in the third day, or period of the creation, when He made the present varied vegetation of our planet. Who tells us that God cares for the fresh flowers and green grasses still?"

"Jesus!" replied Hettie, quoting quickly, "Consider the lilies of the field how they grow."

"You are right; for the context speaks about Him as clothing the grass of the field—so what lesson is this for us?"

"That if God keeps the flowers He will keep us," answered Susie.

"He will keep us, dear, if we follow the injunction which Jesus adds: 'Seek ye first the kingdom of God, and His righteousness.' For this *seeking* means *finding* Jesus for our Saviour, God for our Father, and the Holy Spirit for our Teacher."



CHAPTER VIII.

BOTANY.

"PERHAPS some of my last thoughts yesterday evening were about our subject—Botany. Certainly when I was half awake in the night, I gave you, in imagination, an account of the writing-paper of the ancients. What do you suppose it was?"

"It was leaves," replied George.

"Yes; the Greeks and Romans wrote their books upon the *pellicles* or thin coats of the leaves of the Egyptian plant, called in the language of Egypt, *byblos*, hence the Greek name *biblion* for a book. The Latin *liber* means a covering or coat, and is derived from the portion of the leaf used. The byblos of the Egyptians, or the papyrus tree, grows in damp ground, and often reaches more than ten feet in height. To prepare it for the pen, layers of the leaves were placed flat upon a board crosswise on each other and pressed; they were afterwards dried

by sun-heat, and finally fastened together by the water of the Nile, which possesses some glutinous properties. Now tell me of what our own paper is composed."

"Rags," shouted the children.

"And of what are rags made?"

"Old linen," said Nellie.

"Cotton of all kinds," answered Susie.

"Now, what is linen?"

"Flax," replied Hettie in a moment, and Susie added, "Cotton is made from the beautiful snowballs of cotton on the cotton-tree."



"Yes; that is it; we, too, like the ancients, write upon leaves, for the fibres of the flax-leaves are used for the linen rags, and the filaments of the cotton-pod are but leaf developments, so that our paper is really only an improvement upon the papyrus of yore."

"Then this is why we call the pages leaves, because they *are* leaves?" said Nellie in amazement. Nellie's words caused a smile.

"The fibres of leaves, and in fact all the parts of a plant generally are composed of *cellular tissue*. This tissue is exceedingly fine, and the cells are often minute. Its constituents, that

means the various things of which it is made, are *carbon*, *oxygen*, and *hydrogen*. *Nitrogen* is added as a fourth element to these three in forming the contents of some of the cells. Plants take in the substances and gases which enter into their composition principally by their roots, this is *absorption*. They also give out gases and vapours in changed form by their leaves, which are furnished with numberless tiny stomates, as I have told you, and this is one purpose of these mouths. The process is called *transpiration*. *Assimilation* means utilising, or using up the various gases, minerals, and earths that compose a plant, for the nourishment and growth of each part. This is all carried on in the cells, which contain many things beside the one already named. Some cells have different gases, some have atoms of silex, or starch, or sulphur, or potassium, or iron, or magnesium, or sundry other substances. Plants grow by the multiplication of their cells, thus, as each cell of a growing plant becomes full, the contents divide, and tissue quickly grows up between the two portions, and forms two tiny cells. These two increase until they become full sized; then they again divide, and so on continuously. The shapes of cells vary. Some are nearly circular, some are egg-shape, some oval, some pointed, some dented in; others are long,

and these long cells form the veins. As plants have not special vital organs like animals to sustain life, they are provided with other means for keeping up the vital principle. The wind itself is one agent, causing the sap to circulate by oscillation, and become more active in its work of sustaining and invigorating every leaf and stem. Six things are absolutely needful for the active growth of vegetable life. Can you tell me any of them? We have referred to some of them in our conversation."

"Light—rain—warmth," said George, slowly.

"Wind—air, I mean," added Nellie.

"Right so far, and I think that you know one more."

"Earth?" asked George.

"Yes; soil—the sixth I must tell you, though you ought to think of it."

"Thunder you mean!" again exclaimed George.

"Not the thunder, dear boy, but the lightning —that is, electricity. Let me, however, arrange these six elements, and briefly tell you their uses as regards vegetable life. *Soil* comes first I think, and from the soil plants derive all the mineral and nitrogenous substances that compose them. *Water* is the second requisite for plant-life, and it holds these substances in solution, so that the roots can draw them up easily. It also supplies

an allowance of moisture for evaporation through the leaves, &c. *Light* comes third, and is necessary to produce carbonaceous substances, such as starch; and also the beautiful chlorophyll granules, or green coloured particles. *Heat* is the next. A plant requires some heat to make it grow at all, and more to make it flower, and still more to ripen the fruit. *Atmosphere* is needed, because the air contains oxygen and carbon; plants absorb both. *Electricity* seems to have to do with what is called the *protoplasm*, or commencement of vegetable life, and it influences the growth of the cells and their contents.

"Classification is another branch of botany. Plants are classified generally as flowering plants and non-flowering plants. Flowering plants are divided into Dicotyledons and Monocotyledons. Dicotyledons have two cotyledons in each seed, as the common broad bean. Monocotyledons have only one cotyledon, as the oat. Under non-flowering plants we have ferns, lycopods, mosses, lichens, fungi, and sea-weeds. The divisions and orders under these primal divisions are numerous. We have just time now for a few seasonable words about the present produce of the land, now so rapidly attaining its golden glory in the brilliant beams of yonder warm and glowing sun. What is growing in the fields around, Lottie?"

'Wheat," said Lottie, "and barley, and grass."

"These are all grasses, dear; as well as oats, and the sweet hay that was gathered in in June. Maize, which, you know, is sometimes given to the poultry and game, is also a cereal or grass, and it is the largest kind. By-the-way, the name cereal is derived from the old Roman goddess of corn, who was called Ceres. The sugar-cane is also a cereal, its juice is pressed out by rollers, then boiled and clarified to make sugar. Barley too contains sugar or saccharine matter in large quantities, but it is in the grain, whereas the sugar-cane has the sweetness in the stem.

"Botany is almost inexhaustible; it comprehends so much knowledge of various kinds. Vegetable life is not only extensive, but widely different. In hot climates it is luxuriant and almost gaudy in the gay colours of its flowers, and in cold regions it dwindles down to pale delicate moss, almost bleaching beneath frosty snow-wreaths. One God made all the fair covering of our globe, and he designed the endless uses of roots, stems, leaves, flowers, and fruits for food, medicine, clothing, literature, and for defence and protection too. For what should we do without our 'wooden walls'? Even our coal is a vegetable growth of ages long gone by. We spoke last time of 'the lilies of the field,' and

God's care for them; these lilies were the scarlet martagon lilies, and 'even Solomon in all his glory was not arrayed like one of these.' One part of Solomon's glory was his knowledge of the vegetable kingdom. We read that 'He spake of trees, from the cedar tree that is in Lebanon even unto the hyssop that springeth out of the wall.' We can never attain to his wisdom, but the more we know of God's works, as well as of His Holy Word, the more we shall see of His wonderful wisdom and love."





CHAPTER IX.

ELECTRICITY.

"HOW silly people are to be afraid of thunder-storms!" said George, with a slight curl of his lip, as the command was peremptorily repeated to Nelly, Hetty, and Lottie, "Come away from the window."

In slow obedience the young children turned, as another rolling peal of thunder reverberated along the valley, and died away. The mother glanced out through the glass doors that opened on the terrace as she led the little party across the room, and that glance brought a thrill of sorrowful terror and agony, as she exclaimed: "The two cottages below have just been struck by the lightning!"

The storm was raging on the left. Riven ragged clouds were driving darkly in the wind, severed by the frequent flashes and then furiously hurled together again, thundering wildly in the clash. To the right, the clear blue sky was cut by

the outline of the "Ringland Hills," and brilliant sunshine from the west falling on the distant raindrops, painted a grand rainbow across the strange scene. The dense smoke from the cottage chimney rose for some feet, and then was carried by the wind in clouds of filmy softness, and drifted along the ground. But only for a moment, as almost instantaneously smoke issued from the whole line of roof, and in less than two minutes this was succeeded by a burst of fiery flame that defied description.

"George, run down at once to the cottages and ask if the people are all safe," cried the mother, and the boy darted off down the field, and quickly returned with the news that all had escaped unhurt; but, being sent again, he once more came back with the sad tidings that three persons were dangerously burned in trying to save their property by venturing into the flames. Sympathising villagers were vigorously helping, and all was done that could be done, but the fire burned on in awful grandeur during the evening and all through the night, until only a gable, and a chimney, and some broken wall remained in ruinous clearness above the burning mass below.

Although this happened more than a fortnight ago, the fire is not extinguished nor the embers cold. One only survives of the three who were

injured by the heat. The husband and his wife have been laid side by side in the pretty village churchyard by deeply sorrowing and solemnised friends.

"What set the cottages on fire?" asked Lottie.

"The people say that a thunderbolt struck the top of the chimney and rolled along the roof, and fell off at the other end," replied Nellie, who had been with George, and soon collected the village news; and she added, "What is a thunderbolt, mother?"

"I do not know, Nellie, and I never met with any description of one; but I think that the electricity or lightning set the cottages on fire by directly coming in contact with the combustible reeds which thatched the roof. The curious round stones which have a slight scent of sulphur and appear radiated from the centre when broken, may be fusions caused by the lightning as it strikes on particular spots, and melts up the substances that obstruct it. At any rate I know that high rocks and mountains often have a molten appearance at the tops caused by lightning. Also hardened tubes are found in sand, which have been made by the lightning dashing through the particles, and melting them together in its rapid raid. One of these tubes, or *fulgurites*, was found at Paderborn, which was forty feet long."

"Will you tell us what lightning is?" inquired George.

"Lightning is visible electricity, dear."

"Then what is electricity?" continued the boy.

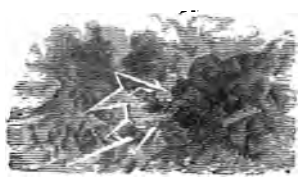
"Electricity is a force, a hidden power, an agency that is at work in all things, to a greater or less extent. It is better known to us by what it does than by what it is. Formerly it was considered a fluid, but learned men do not admit that it is so now. It is a two-fold force. In one body it may be an attractive force, drawing things towards it, it is then called *positive;* in another body it may be a repellant force, driving things from it, and it is then called *negative.* Electricity is also a pure mechanical force, and seems governed completely by mechanical laws. Some substances are not easily affected by electricity, such as air, silk, glass, &c., and they are then called *non-conductors.* Other substances, such as metals, water, and human bodies, &c., are called *conductors,* for they easily respond to its strange influence.

Immeasurably swift in its movements, it is almost impossible to calculate the rate at which it travels. The heat, too, of electricity, is intense, and its light vivid.

"Now tell us what the thunder is; it *seems*

more dangerous and awful than the lightning, I think; especially when it makes that crackling sort of noise," said George.

"The danger is over, and the damage done, when the thunder clap commences. I have almost a feeling of safety as the sound breaks forth, for I know that the flash which caused it has passed by. Thunder itself is merely the noise caused by the rapid rush of the electricity through the clouds and the meeting of the clouds again. The atmosphere, being a non-conductor, has a tendency to keep the electricity safely in the clouds, but when two clouds meet, and one is very full of positive electricity and the other is charged with negative, if the tension is great enough to overcome the power of the atmosphere, the clouds discharge some of their electricity, and, as it comes in contact with the rain, or the cloud itself, a flash of lightning is struck. Then follows the sound of the thunder as the clouds close, and Sir John Herschel attributes the roar partly to reverberation and partly to a 'combination of sounds,' which combination is caused by the path of the lightning. For, if the electricity run along the cloud in a straight line, the sound



reaches us gradually as it flies farther away. If the lightning take an inclined path, the sound reaches us more quickly from each point of that path; this causes a quick, sharp thunder-clap. If it take a curve and form a circle the sound is almost instantaneous, and causes that sharp, deafening crash, which is so startling in its sudden strength. Do you not remember how the sound of the firing at Southsea ran along the lines of soldiers?"

"Indeed I do, at the review," replied George.

"Summer lightning, commonly called sheet lightning, is without thunder. The air is heated and cannot resist the electricity with its usual power, so that the lightning quietly escapes in those soft, bright, bluish, spreading flames, which so beautifully bathe the fading horizon with fair flushes of liquid light."

"Can it hurt anybody?" anxiously inquired Nellie.

"No, dear; it is harmless, because the electricity is not in sufficient quantity to cause any damage. The lightning that set the cottages on fire was followed by a crashing, crackling peal of thunder that told how strong the discharge had been."

"How could God let those cottages be burned, and the people too?" asked Lottie with tearful eyes and swelling heart.

"Ah! Lottie, your question is natural, and can only have one reply. God is a King, darling, and rules everything carefully in the best way. His *sovereignty* is quite above our understanding, but we may look up to Him in loving, fearless faith and say, 'Even so, Father: for so it seemed good in Thy sight.' We have no right to question either His wisdom or His power, for He is so much higher than the wisest and the strongest. But, Lottie, if we get to His heaven, through the love of our Lord Jesus Christ, and we *may* all get there through Him, then we shall know and see that the great God who has 'made . . . a way for the lightning of the thunder' has always made that 'way' wisely and well."



CHAPTER X.

ELECTRICITY.

"SHOOTING stars have been particularly brilliant lately; some very splendid ones swept across the sky last evening. Nellie's description of them is rather funny. She tells me that she saw some as she walked over from Morton, and that they looked like the heads of pins darting across the sky! They are really caused by the electricity in the atmosphere taking fire, because it comes in contact with some obstruction."

"How? What is obstruction?" asked George.

"Something in the way. Electricity will ignite or light up almost like a match when it is struck."

"Oh! I see," said the boy; "you mean that it is like the 'patent safeties,' and when it rubs against the right thing off it goes!"

"That is a fair illustration. Besides shooting stars, it is thought that the currents of electricity

produce water-spouts and whirlwinds. Do you know what they are?"

"No," replied Hettie very bluntly.

"Water-spouts are seen at sea, Hettie; the waves seem to boil and smoke, and the water is gradually drawn up in a conical shape until it forms a pillar between the sea and cloud. It is thought that electricity causes all this turmoil. Whirlwinds are terrific local winds, whirling round and round. They carry up the dust in a circular sort of way that looks like a pyramid; and even trees, bricks, stones, earth, and other things are driven about by these winds almost as if they were straws. As they generally occur when there is electricity about, there seems to be no doubt that they arise from its influence. Earthquakes, too, are traced to the same power, and principally happen in hot countries. They are probably the result of an escape of electricity from the earth. South America has suffered terribly from them. Volcanoes also are similar to earthquakes. Tell me the names of some volcanoes."



"Hecla," cried George, immediately.

"Etna and Vesuvius," said Susie and Nellie together.

"These are the three principal. Where are they?"

"Hecla is in Iceland," shouted George.

Vesuvius is near Naples, in Italy," replied Hettie.

"And Etna is in Sicily," added Susie.

"The Aurora Borealis is perhaps the most beautiful appearance produced by electricity. Do you remember how very splendidly we saw it last winter, Susie, from the north window, one evening near Christmas?"

"I do," said Susie; "the panes were frosted over, and you opened the window to look out."

"Yes; it was intensely cold that night, and as we were so near to the north-east coast of Norfolk, there was very little except the sea and ice between us and the North Pole. The light from the Aurora was nearly equal to daylight for some hours, and the glowing streaks of whitish glare were almost dazzling. The Aurora can only be seen when the air is very thin and cold. That is why it is so vivid in Greenland and Iceland. The electricity darts and waves about freely in those rare mediums; it would be prevented from doing so in the usual state of the atmosphere, as air is a bad conductor for it. In lands of ice, snow, and long wintry darkness, the Aurora Borealis is a great comfort to the poor inhabitants,

for it gives them light when they would otherwise be in total night for many weeks together. I must not forget to tell you about the strange fishes which possess the power of giving electric shocks."

"You mean electric eels?" interrupted George.

"There are three kinds, dear, and this eel is one. The torpedo is another. You saw a torpedo in the tropical room in the Aquarium at Brighton."

"Yes," said Susie, "it had a sort of cage over it."

"Probably to protect people from its power. The electric organs of this flat fish lie on each side of the gills—the gills are those curious breathing places which fishes possess—and if the hands are placed near to the gills the shock is violent. Even if you touch any part of the torpedo, you would feel a slight shock. This creature is found in several places on the coasts of Europe, and grows to the length of twenty inches. Another fish which possesses electrical power is the South American eel. It is a native of the large rivers in that continent, and is rather dangerous. Small fishes are easily killed by a shock from it, and this eel devours them afterwards for food, if it is hungry. The third electrical fish is a native of the mud in some of

the African rivers, but this last is not well known."

"I believe I remember how someone caught the eels in South America," remarked George. "Tell us about it, please, Mother."

"I will. Your 'someone' was Humboldt, who was a great traveller. He was crossing the Llanos, in South America, and he was told that electrical eels were very common near to a small town called Calaboza. As he wished to secure some, he asked the people to help him, and he was taken to a kind of muddy lake, where they were abundant. The natives drove about thirty horses and mules into the lake to disturb the fish. These poor animals were rendered almost frantic from the electric shocks which they received, and if they attempted to escape the natives frightened them back with bamboos. As they aroused the horrible eels, they glided under the horses and mules and gave them repeated shocks. Two of the horses were soon convulsed by the terrible pain and sank in the muddy water, where they quickly died. The others were finally rescued and revived. The eels, after thus pursuing the intruders and swimming actively amongst them, were at last almost exhausted, and whilst they were so, Humboldt captured as many as he cared to possess."

"How horribly cruel," said Hettie, feelingly.

"Yes; I think it was extremely cruel to make the poor horses and mules the victims of such deadly and disagreeable foes. I am quite sure that the kind God who made all the dumb animals, and who allows us to use them in various ways, and even to kill them for our food, never intended us to give them any needless pain. That God will surely judge those who do. When I see a boy beating a horse, or jerking its tender mouth, or in any way worrying and hurting it, I cannot help feeling that sooner or later that boy will be severely punished, and have to bear pain himself. Little children, too, who tease flies or worms, or any tiny insects, will one day be judged for their cruelty by the gentle Saviour Himself. We ought to try *always* and in *every* way to make life happy and bright to the dumb animals around us; and it will make us far happier to be loved for our good actions, than to grow up disliked and despised for our cruel and selfish deeds.

"We have traced electricity throughout this world—in the earth itself, beneath it, in the air around it, in the living creatures upon it, in the clouds above it.

There is a verse in the Bible that says, 'The God of glory thundereth;' we also read that out

of *His* Throne 'proceedeth lightnings and thunderings and voices.' This may teach us a little of His unceasing glory and power. He remains unchanged in the midst of those mighty forces that would destroy any finite beings, and consume them in a moment. Earthly brilliancy and grandeur is but short, but if we seek for salvation in God's way, we may, by believing in Jesus, live for ever in the glory and brightness of the presence of His Father in heaven.





CHAPTER XI.

MECHANICS.

"MY dear boy, do take the pump-handle at the end, to fill your watering-can. You lose so much in strength by holding it near to the pump itself."

"Do I, Mother?" asked George; and he quickly added, "but if you notice you will see that I have less way to go with my arm, and to me the saving in distance is better than saving my strength, for it never hurts *me* to pump."

With another stroke of the handle George filled his can up to the brim, and promptly carried it away to water his plants in the garden. As usual, a quiet opportunity for talking came very nicely after a time, and the mother asked:

"George, do you know what the handle of the pump is?"

"You would call it a lever, I suppose, and I

daresay that I *ought* to ask what a lever is. At anyrate I know what it is for, and that it is used to raise things."

"It is; and a lever is one of the six mechanical powers. Let me see if I remember them, it is so long since I learned them. The lever, the wheel and axle, the pulley, the inclined plane, the wedge, and the screw. All these six forces are most valuable to man, as they give him power over motionless matter, and enable him to use that matter for all his requirements. Tell me what matter is?"

"The thing you want to move," replied Nellie, guessing at this from the idea of a lever.

"All substances, dear, may be called matter. For instance, the large stones for building our houses, the heavy timber for our ships in the dockyard, the coals that we burn, metals, minerals, &c., are each and all matter, and could never be applied, as they are, for our comfort without the practical use of mechanical power. The weight of matter arises from the force which is usually called the attraction of gravitation, which I will explain. The centre of the earth possesses the power of drawing everything towards it, and this power is affected by both distance and density. Do you know what density means?"

"Thickness," said George.

"Yes, that will do; and this density or thickness accounts for what we call the weight of things. To conquer this attraction or weight we require literal strength in order to move any object, and for this purpose the lever is the most simple and therefore the first mechanical power. The point on which the lever rests and plays is called the fulcrum, the thing to be moved is the weight, and the moving hand is the active force. When George was pumping to water his plants the farther his hand was from the screw, which is the fulcrum of the pump-handle, the less the weight appeared to him, because the increase in the power of a lever is in proportion to its length. George was quite correct in his remark though about distance and time. For the nearer the moving power, which in his case was George's hand, is to the fulcrum, the less the distance will be that that power has to travel, and also it will take less time to go over the shorter distance. So that, as a rule, levers lose in time what they gain in strength. The wheel and axle is the second mechanical power, and the larger the wheel the greater is its advantage; for its power is greater in proportion as the circumference is greater than the axle. Country draw-wells are formed on the principle of the wheel and axle, the bent iron handle which is turned to raise the bucket, answers

the purpose of a wheel. The crane, capstan, and windlass are adaptations of the wheel and axle."

"Oh, is the crane a lever? I like to watch the cranes at Portsmouth Harbour," said George.

"Yes; and my sewing-machine is another example of the use of the wheel and axle. The whole motion of the machine depends upon the large wheel, and the larger that is, the more rapid the work; and this is the case with all the machinery in our various factories. The pulley is the third power, and, after all, pulleys are really systems of leverage. The wheel forms the fulcrum, the object to be raised is the weight at one end of a rope which passes over the wheel, the power employed being connected with the other end of that rope. Sometimes many pulleys are connected one with the other, the same rope or chain playing over every wheel, and thus each wheel increases the power in proportion to its circumference."

"Can you tell me now to which of these three powers my 'Mordan' letter-scales belongs?"

Susie suggested the wheel and axle, because they *seem* to have an axle.

"No; it is a pivot, on which the beam is balanced."

"Besides," said Susie, "of course there is no wheel, so it is a lever I think."

"Yes; dear. The fulcrum is in the centre. The letter if laid upon the plate is the thing to be raised, and the weight in the round scale is the moving power. Though if you place the ounce weight upon the scale first and then lay the letter upon the plate, it is to be hoped that your power, in this case, may fail to move the weight if you wish your letter to go safely for the penny stamp. Many of the muscles of our bodies are levers, living levers. If we lift with the hand, we use muscles that have one insertion in the shoulder-blade, that is, one end of each is fastened to the shoulder-blade, the other end of each influences the hand, and owing to the position of the elbow round which these muscles pass, they gain great power. We may talk of this power and that power, but all these lesser powers are but manifestations of *our Father's* power, who first planned them, and who teaches us their use. Who is 'Our Father,' Lottie?"

"God," replied the child.

"God *is* 'Our Father,' I hope, darling; and I am sure that He is if we love His Son Jesus with all our hearts, and the wonderful power of His Holy Spirit can raise the souls and bodies of His creatures to a higher state of life, by spiritual power far more easily than man can raise the atoms of this lower world."

CHAPTER XII.

MECHANICS.

"SLIP, slip, slip—there go the little ragged boys down the slope. Hettie, do you see them? That is both a novel and comical amusement!"

The castle at Southsea stands on the wide, breezy common, and close to the sea. It forms an imposing object at a prominent angle of the beach, with its heavy-looking grass-grown earthworks, and its black cannons peeping through them. A massive stone embankment surrounds it seaward, with a very pleasant path at the top; and on the shelving sides, when the tide is low, numbers of small boys amuse themselves by sliding down. Not in the usual way, though. Each boy selects a large, flat stone, sits upon it, and gently launching it from the top, makes a rapid descent to the soft sand many feet below. The children stood to watch the boys, and were as much amused as the sliders themselves.

"We have a very nice inclined plane here as an illustration for our subject to-night," said the mother, "and the boys are certainly apt in showing to us the use of this fourth mechanical power."

"They *do* go quickly," said Lottie, laughing.

"Yes; the slope accelerates their pace, and by placing the smooth stone under them the boys overcome much of the friction."

In the evening the subject was renewed, and Hettie asked:

"Will you tell us about the plane?"

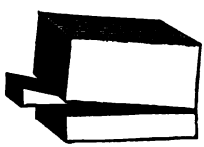
"The inclined plane is used principally for raising or lowering very heavy weights for short distances. George and I saw a man move an immense cask by means of one when we were near the Palmerston Road the other day. The man backed his dray up to the low door where the cask stood ready, and placed a wide plank firmly on his dray at the one end and close to the cask at the other. With very little trouble he then slowly rolled it up and fixed it safely on the dray."



The longer the plane the more easy the ascent is, but just as in the case of the lever, you lose as to time, for a longer space must be travelled.

Some tools are made on the principle of the inclined plane, and have one edge sloped, such as the hatchet and the chisel. This brings us to the fifth mechanical power—the wedge—which is, in reality, two inclined planes joined, with the thick ends fixed together, and the thin ends meeting, so as to form almost a point.

"Wedges are used for splitting wood," said Susie, "but are they for any other purpose?"



"Yes; they are sometimes employed to raise immense weights, and are more powerful for this purpose than the lever, the pulley, or the inclined plane, provided that the distance that the weight is to be raised is small. This extra power is because they are driven in by force, rapid, strong strokes of a hammer, whereas, the propelling influence in the other cases is usually merely heavy, dead sort of pressure. Large ships are frequently raised by wedges in the docks. Did you see this when you went over the works at Portsmouth, George?"

"No, certainly not, I did not see any ship-building. We went over a large steamer though."

"Perhaps you may go another day soon, and see this. I will now tell you one very clever use

of the wedge that will interest you, I know. In Derbyshire it is employed to separate the mill-stones from the rocks in whole masses. The workmen first of all bore holes at regular distances all round a marked out circular piece of silicious rock. Into these holes they drive dry wedges, or 'pegs,' as they call them. Presently the pegs grow damp from rain, or fog, or even from the moisture in the earth below the rock, and before many days they gradually swell, and gently lift up the mill-stone, without even cracking it, quite ready for the workmen. I think that we may fairly reverse the old Derbyshire adage, and in this case say—Weak in the arm, and strong in the head!"

The children smiled, for they well knew the old rhyme.

"Now for the screw, the sixth and last mechanical power. Tell me what a screw is."

"A thing with a spiral all round to make it go in easy," said George.

"Yes; that is the screw for fastening tightly two pieces of wood or iron. The mechanical screw is on the same principle. The centre of the screw is a steel or wooden rod or cylinder, for some are made of iron and others of wood. The spiral curves round it are

called the thread, and in common language the groove in which the thread works is called the 'worm.' The groove is inside the nut which is turned by a handle. Sometimes in very simple screws a common lever is used to turn the nut, and by long levers great pressure can be produced. Printing presses, as you have seen, are worked by screws. Coining, too, is effected by a screw machine. They are used also in paper-mills for pressing the water from the freshly-made paper. I have no doubt that they have very powerful screws at Taverham, where the paper for the *Times* is all made. You remember the mills, do you not?"

"I do," said George.

"I should think so!" emphatically added Nellie.

"Screws are in common use in our homes too, for linen presses, and for cheese presses, as in Derbyshire; for cider presses, as at Montacute, in Somerset, and in Devonshire; and we have also an endless variety of screw work applied to assist daily labour in all business departments."

"Washing machines are screws, or at least, the mangling part of them," remarked George.

"That depends upon how they are made, dear. We will examine one some day, when we have an

opportunity. How much higher than the mere animal world God has made man! How wonderfully, too, has He taught him to exercise and increase the inventive and adaptive powers which He has given to him! Even you and I can, and do, use mechanical powers, all the six, hundreds of times in the day, unconsciously. And we do not know, much less understand, the varied ways in which great engineers, and architects, and inventors use these powers in their different lines of work. God made man to live for ever, and to increase in wisdom like His own dear Son, who was sent as a pattern for our imitation, as well as a Saviour from our sins. We are to follow His example in all things, even in the study of science, and I often think that our knowledge gained on earth may be training us for the higher knowledge which God promises that we shall have in His heaven. Tell me, Lottie, what it is that prevents people from loving our kind Father who is in heaven?"

"Satan," said Lottie, in a moment. "Sin," answered Nellie.

"Yes; and who both lived and died to take away our sins?"

"Jesus," replied Lottie.

"Who only can teach us that we are sinful, and make us holy?"

"The Holy Ghost," said Hettie, very softly.

"To know all this, dear children, will alone prepare us for everlasting happiness. Oh! may we ask earnestly for the Holy Spirit of God and Jesus to lead us into the knowledge of all truth!"

LORIMER AND GILLIES, PRINTERS, 31 ST. ANDREW SQUARE, EDINBURGH.

WORKS BY SELINA A. BOWER.

I.

Crown 8vo, 3s. 6d., Handsomely Bound in Cloth, Gilt Edges.

FROM ADVENT TO ADVENT.

Pieces in Prose and Poetry on Subjects selected from Sunday Services.

"The meditations are short and pointed, and the poetry is frequently graceful."—*The Christian.*

"A suggestive and helpful volume, whether for private meditation or Sunday-school teaching."—*Christian Progress.*

"We hardly know which to commend most—the admirable arrangement of the work, or the excellence of its composition."—*The Derbyshire Advertiser and Journal.*

"A series of brief, thoughtful, and ably written meditations. The poems are the spiritual utterances of a devout mind."—*Hand and Heart.*

"Very high praise is due to the talented wife of the Vicar of Ringland, not only for the conception of this work, but for the admirable way in which she has carried it out, and the remarkable literary ability therein displayed."—*The Norfolk Chronicle and Norwich Gazette.*

"Every page contains instructive and edifying matter."—*The Voice of Warning.*

"A valuable volume."—*The Rev. Hely H. Smith.*

II.

1*s.* 6*d.* *With Illustrations.*

THE CHILDHOOD OF DISTINGUISHED WOMEN.

"An unpretentious little work, well suited for distribution among the young."—*The Christian.*

"An interesting little volume. It is specially suitable for children."—*Christian Progress.*

"The sketches, twelve in number, are written in a highly intellectual, refined, and cultivated style."—*The Derbyshire Advertiser and Journal.*

"A very instructive little volume. The work is prettily illustrated, and will doubtless be found very acceptable as a gift-book."—*The Rock.*

"We can confidently recommend the book as a suitable prize for girls."—*The School Guardian.*

"This little work of eighty-three pages is tastefully got up and attractively written."—*The Voice of Warning.*

"Instructive reading, well bound, well printed on toned paper, and evangelical."—*Wayside Words.*

LONDON: JARROLD & SONS, 3 PATERNOSTER BUILDINGS.

III.

Crown 8vo, Cloth, Illustrated, 1s.

LET THERE BE LIGHT;

OR, THE STORY OF THE REFORMATION.

"'The story of the Reformation,' so necessary in these days of Protestant declension to be kept in memory by young and old, is admirably detailed. . . . Told in language accommodated to the understandings of children, albeit there is nothing 'childish' about it."—*The Derbyshire Advertiser and Journal.*

"This is a successful attempt to place the leading facts connected with the Reformation before young people in a way both lucid and interesting."—*Norfolk Chronicle.*

"We can warmly recommend another history of the Reformation, illustrated and adapted for children. 'Let there be Light' is a series of conversations between a mother and her five children concerning the principal persons and events connected with the great revival in Germany, and which are specially devised to lead to the understanding of the grand truths of the Gospel, which the Reformation brought to light."—*Clergyman's Magazine.*

LONDON: JAMES NISBET & CO., 21 BERNERS STREET.

Works Just Issued by James Nisbet & Co.

POPPIES AND PANSIES. By EMMA MARSHALL. Crown 8vo, cloth, illustrated, 5s.

SIR VALENTINE'S VICTORY, and Other Stories. By EMMA MARSHALL. Crown 8vo, cloth, illustrated, 3s. 6d.

DAINTREE. By BERNARD HELDMANN, Author of "Dorrincourt." Crown 8vo, illustrated, 3s. 6d.

KATHLEEN. By Miss AGNES GIBERNE. Crown 8vo, illustrated, cloth, 5s.

LADY TEMPLE'S GRANDCHILDREN. By Miss EVERETT GREEN. Crown 8vo, cloth, illustrated, 3s. 6d.

MISS MARSTON'S GIRLS AND THEIR CONFIRMATION. Crown 8vo, cloth, 2s. 6d.

ALICE'S PUPIL. By Miss M'LINTOCK. Crown 8vo, cloth, 1s. 6d.

PARABLES OF JESUS. By the Rev. JAMES WELLS, Author of "Bible Echoes," &c. Crown 8vo, cloth, illustrated, 5s.

LONDON: JAMES NISBET & CO., 21 BERNERS STREET.

